A CONVENTIONAL SINGLE-PHASE FULL BRIDGE CURRENT SOURCE INVERTER WITH LOAD VARIATION

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Abstract: *This paper presents a conventional single-phase full bridge current source inverter with load variation. Different operational modes of this inverter are depicted. A novel rectified sine-triangular wave pulse width modulation technique is applied. The firing signals of the each of the power switch are generated from comparing rectified sinusoidal wave as the reference with triangular wave as carrier signal. Waveform analysis has been detailed to obtain the harmonic amplitude of the output current. This paper reveals that convectional single phase current source inverter operates with different loads generates variable percentages of THD with constant modulation index of 0.8 and frequency modulation index of 40. The simulations have been done in MATLAB/SIMULINK to showcase the harmonic spectrum, output voltages and currents waveforms.*

Keywords: *Current source inverter, sine-triangular pulse width, harmonic amplitude, inverter, MATLAB simulation.*

1. INTRODUCTION

This paper aims to extend the knowledge about the voltage source inverter to current source inverter topology. Generally, Inverters can be categorized into two types such as single phase inverters and three phase inverters. Inverters are also classified as voltage source inverters where the small or negligible reactor is connected in series with voltage supply and current source inverter where high inductance is connected in series with voltage supply. Due to continuous research on inverter topologies, consequently inverter can be subdivided into two namely conventional inverters and multilevel inverters. Thus, conventional inverter has a maximum of two output voltage or current level. Due to this low voltage level, conventional inverters are associated with high output harmonic content with less number of power switches. On the other hand, multilevel inverter configuration has a minimum of three output voltage level with reduced harmonic content and increased number of switches.

Unlike voltage source inverter which are very common and in wide use due to merit accorded to them, conventional current source inverters are not because of large inductance (reactor) that is involved in their practice to generate dc input current. VSI has dc voltage input as its supply, while CSI has dc current as its source. The dc voltage electricity sources available such as batteries, solar panels or fuel cells are converted to dc current source by connecting in series a large inductance to establish current flow in the circuit. CSI can also be generated from a rectified ac voltage and filtering the ripples by a large reactor to produce dc input current I_d which flows into the inverter input and this value is independent of inverter load [1] as shown in Fig 1. Due to unavailability of feedback diodes, the CSI is short circuit proof. The only vivid demerit of this inverter topology is the weight of the reactor which increases the bulkiness of the inverter. Among other unidirectional switches that can be used in the design of this inverter include: (A) a Thyristor in which case there must be external commutation circuit, (B) Gate Turn Off thyristor (GTO) here positive current turns it ON or otherwise, (C) Transistors (BJT, MOSFET, IGBT) which cannot withstand high reverse voltage and therefore needs series diode.

The current source inverters have the following merits [2]:

- Since the input current is constant; misfiring of [illegible] and short-circuits do not pose any problem.
- Peak current of devices is limited.
- Commutation circuit is simple.
- It can handle reactive or regenerative loads without freewheeling diodes.

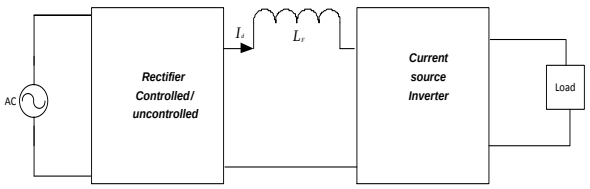

Fig. 1 A block diagram of a current source inverter from AC power source

Some typical applications in which inverters may pay a pioneering role are variable speed ac drives, induction heating, stand-by power supplies, uninterruptible power supplies (UPS), traction, high voltage direct current transmission, static Var compensation and soon [3].

This paper presents a conventional single-phase full bridge current source inverter with load variation. This paper is structured as: In section I, the concept of current source inverter topology. Section II presents the circuit configuration and operational principles of the proposed inverter. In section III the novel pulse width modulation